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## No. IV.

## PREVENTION OF EXPLOSION IN STEAM-ENGINE BOILERS.

*The GOLD ISIS MEDAL was presented to Mr. ROBERT M'EWEN, Glasgow, for his Double Mercurial Safety-Valve for Steam-Engine Boilers; a Model of which has been placed in the Society's Repository.*

17 Henrietta Street, Russell Square,  
22d January, 1840.

SIR,

I beg leave to submit to the consideration of the Society of Arts the accompanying plan for the prevention of explosion in steam-engine boilers, in the hope that it may meet with their approval. Other methods of construction on this principle might be shewn, but I consider that which I have given as the best for practical use.

Though no combination of machinery, however simple, can be made so simple as to dispense with human superintendence, yet I trust that this apparatus, with a little attention, would be found adequate to the prevention of explosion from excess of steam or deficiency of water.

I am, Sir, &c. &c.

W. A. GRAHAM, Esq.

ROBERT M'EWEN.

Secretary, &c. &c.

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There are two evils against which it is especially necessary to provide in the construction of an apparatus

for preventing explosion in boilers, viz. the possibility of the steam passage being intentionally closed, for the purpose of obtaining extraordinary pressure; and the failure of the self-action of the apparatus through the accidental derangement of its parts.

Mr. M'Ewen's apparatus consists of a pair of open tubes, the ends of which are immersed in mercury contained in cups connected with the boiler by a pipe. At the junction of this pipe with its branches for the two cups, is a three-way cock, the ports of which are so proportioned to the openings of the branch pipes, that the steam can neither be opened on, nor cut off from, both cups at the same time. The mercury tubes are proportioned in length to the greatest pressure which the boiler will bear with safety; the mercury will therefore be blown out of the acting tube into the dome at the top, whenever the pressure exceeds this limit, and will fall down through the other tube into the empty cup, while the steam blows out through a pipe at the top of the dome.\* When the pressure is sufficiently reduced, the cock may be turned, and the cup which was last filled becomes the acting side of the apparatus.

On the 7th of April, a committee of the Society inspected the action of Mr. M'Ewen's mercurial valve, the apparatus having been attached to the boiler at the works of Messrs. Fairbairn and Murray of Mill Wall. The steam was opened on the mercury at a pressure of five pounds to the square inch, and as soon as it attained the pressure corresponding to the length of the tubes, viz. seven pounds, the mercury was blown, without any loss,

\* Mr. M'Ewen intends that an alarm-whistle be placed in this opening, and also that the apparatus serve as a gauge for indicating the variation of pressure, by means of graduated float-rods in the mercury tubes.

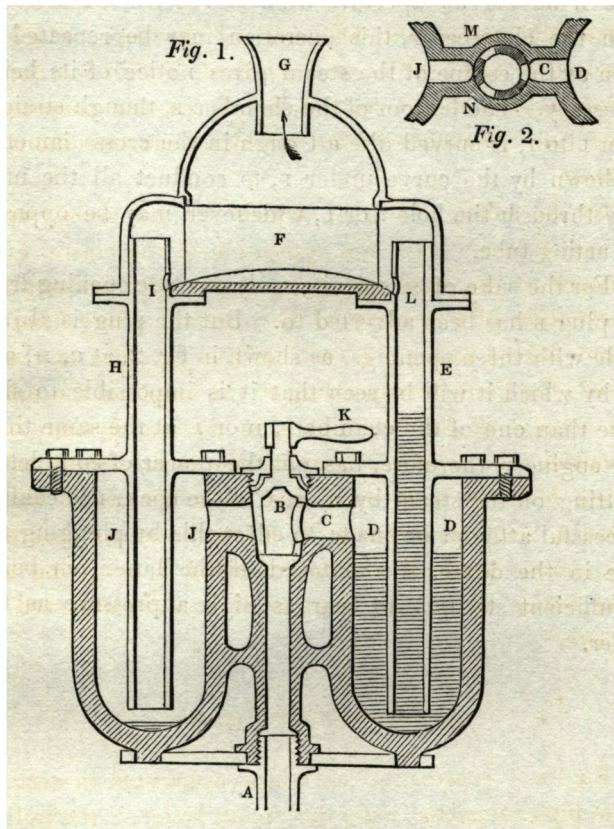
into the dome and fell into the empty cup, while the steam blew out through the pipe at the top of the dome, and was condensed in a vessel placed to receive it for the purpose of experiment. On examination of the water in this vessel, not a particle of mercury was found in it. This result sufficiently proved the efficiency of the pipe, which is produced to some distance downwards within the dome, as represented in the section fig. 1, for the purpose of preventing the mercury from splashing out with the rush of steam.

As the action of this apparatus depends simply on a *physical* principle, viz. the opposition of the elastic force of steam to the static pressure of mercury, without the intervention of a *mechanical* obstruction of any kind, it cannot fail of acting, so soon as the pressure of steam exceeds the limit corresponding to the length of the tubes. The novelty of the invention is in the employment of a mercurial tube as a safe vent for the steam, these tubes having hitherto been used only as indicators of steam pressure, being long enough to allow the steam to attain a dangerous pressure without relieving it or giving any other notice of the fact than what may be observed by the eye.

#### *Reference to the Figures.*

Figure 1 represents the whole apparatus in section. A the pipe connected with the steam boiler, B the hollow plug of a cock with a side opening at C, through which the steam passes into the area D, and pressing on the mercury causes it to rise in the tube E till its weight counterbalances the force of the steam; the tube E opens into the chamber and dome F, to which there is free access for

the atmosphere through the neck *g*; if, therefore, the steam should at any time exceed the due pressure which is limited by the length of the tube *e*, it will drive all the mercury before it up this tube into the chamber *f*, and



will escape through the neck *g*; in the meantime the mercury will enter the opposite tube *h* through the small hole *i*, and flow down into the other vessel *j*, where it will be ready again to act as a safety-valve as soon as the

attendant has turned round the plug *B* by its handle *K*, thus cutting off the communication of the steam with the vessel *D*, and opening it into the vessel *J*. The construction of both sides of the apparatus being exactly alike, the tube *E* having an aperture at *L* to receive the mercury from the chamber *F*, this operation may be repeated as often as the escape of the steam gives notice of its being necessary. The bottom of the chamber *F*, though straight from *L* to *I*, is curved like a trough in the cross diameter, as shewn by the curve under *F*, to conduct all the mercury through the hole *I* or *L*, whichever may be opposite the acting tube.

For the sake of perspicuity, only one side opening from the plug *B* has been adverted to. But the plug is always made with three openings, as shewn in fig. 2, at *c*, *m*, and *n*; by which it will be seen that it is impossible to shut more than one of the chambers, *D* or *J*, at the same time. The engineer, therefore, has not the power of completely shutting off the steam by means of the cock, nor could a successful attempt be made to effect this by plugging the pipe in the dome, the material of the latter not being of sufficient strength to bear as high a pressure as the boiler.